UNIVERSITY OF WOLLONGONG IN DUBAI

Bachelor of Engineering (Honours) - Mechanical Engineering

The Bachelor of Engineering (Honours) degree is a four year degree with a common first year where you will learn more about engineering and its different fields before deciding which discipline to study. The common first year provides you with sound fundamentals in mathematics, statistics, physics, chemistry, computing, engineering science and communication, mechanics, materials and fluids. You then focus on your chosen major study from second year.

To qualify for award of the degree of Bachelor of Engineering in this major, a candidate shall accrue an aggregate of at least 192 Credit Points (cp), which includes two general electives chosen from the general education subjects, in addition to one more general education subjects, for a total of 198 (cp). In addition, completes the professional experience subject ENGG454 and the mechanical engineering workshop subject. Students are also required to accrue an overall weighted average mark (WAM) of 50%. The degree consists of core subjects, major subjects, thesis, electives and general education subjects details of which are below:

Year 1

Engineering Computing and Analysis

This subject teaches algorithm design and computer programming using MATLAB. Students will develop a systematic approach to analyse engineering problems and create algorithms that solve real-world problems. Topics will include: problems solving techniques; algorithm design; data types and operators; conditional and repetitive control flow; file access; functions; data visualisation; code optimisation; arrays/matrices; and vectorisation. Students will also focus on computational tools to solve engineering problems such as kinematics of rectilinear and curvilinear motion.

Fundamentals of Engineering Mechanics

In this subject student will explore fundamental laws of motion and their application to the analysis and design of simple structures. Students will undertake a series of design and build projects to see the effects of concepts of mechanics in real structures. Working in design teams, students will also explore the professional responsibilities of engineers in terms of accountability, liability and sound design and analysis techniques.

Materials in Design

In this subject student will explore the interrelationships between materials structure, properties, processing, application and lifecycle. Students will apply materials science and lifecycle analysis to develop solutions to engineering problem that are optimised for sustainability. Students must consider both economic and environmental impact in the identification and selection of appropriate materials in engineering design.

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Electrical Systems

ENGG104 introduces real-world electrical systems. The subject teaches fundamental electrical concepts: change, current, voltage, resistance, capacitance, inductance, energy and power. The subject introduces theorems to simplify AC and DC circuits through analysis and simulation. The subject also links the fundamental concepts to practical engineering applications such as motors and generators. The laboratory component covers measurements using electrical components and equipment, designing basic circuits, as well as report writing.

Engineering Design for Sustainability

In this subject, students will draw together engineering principles covered in other subjects to develop context-appropriate solutions to engineering challenges. Students will work in teams undertaking investigation, concept development, and detailed design that demonstrates innovative and creative thinking. Students must consider the technical, social, economic and environmental aspects of a design problem to produce solutions that are likely to be workable in the real world.

Foundations of Engineering Mathematics

The subject consists of two strands, Calculus and Linear Algebra. The Calculus strand covers differential calculus and introduces integral calculus. The Linear Algebra strand covers matrices, determinants and applications of these in the sub-topic of vector geometry. All of these are presented with accompanying examples from various engineering disciplines.

Essentials of Engineering Mathematics

The subject consists of two strands, Integral Calculus with applications and Series. The Integral Calculus strand presents a number of analytical and numerical integration techniques plus applications of integration to find areas, volumes of revolution and solve differential equations. The Series strand covers techniques for finding limits, determining the convergence of series and leads into Taylor series. All of these are presented with accompanying examples from various Engineering disciplines.

Physics for Engineers

Vectors and their applications; an introduction to the physical laws of electricity and magnetism, leading to an explanation of the generation of electromagnetic waves and some basic ideas in communication theory. Electric charge and Coulomb's law, electric fields, potential differences, capacitance, dielectrics and relative permittivity, electric current, resistance, Ohm's law, superconductivity, DC circuits and Kirchhoffs laws, magnetic fields and forces, electromagnetic waves and the EM spectrum, carrier waves, modulation and bandwidth. Waves; reflection and refraction; interference; diffraction; polarization; optical instruments; quantum physics; waves and particles; atomic physics; the Bohr atom.

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Year 2

Chemistry For Engineering

The 103 course provides an introduction to basic chemistry through topics applicable to engineering courses. Fundamentals: nomenclature and stoichiometry. Atomic theory, bonding and structure. Properties of matter. Reactions: thermochemistry, thermo dynamics, chemical equilibria, acid base equilibria and kinetics. Introductory organic chemistry. Environmental chemistry: pollution and pollution control. Electrochemistry: redox, galvanic cells, electrolysis and corrosion. Chemical basis of engineering materials such as metals, semiconductors, polymers, fuels, adhesives, concrete.

Advanced Engineering Mathematics and Statistics

MATH283 is a subject for Bachelor of Engineering (Honours) students. The subject consists of two parts, Advanced Engineering Mathematics and Statistics. Each part is worth 50% of the final mark. Advanced Engineering Mathematics deals with new techniques, including partial differentiation, multiple integration, introduction to special functions (the gamma, beta and error functions), Laplace transform, and Fourier series; Statistics gives an introduction to statistical computing, and to basic statistical techniques, including mathematical models for describing variation in experimental situations.

Mechanics of Solids

Stress on a section, concept of stress-strain relationship and Hooke's Law. Torsion of shafts and hollow sections. Problems in bending and stress of beams. Analysis of plane stress and plane strain, combined stresses. Elasticity and plasticity for metals, and inelastic behaviour of non metals. Failure theories. Beam deflections and simple column buckling. Thermal stresses and strain energy concept. Experimental techniques. Recommended minimum preparation is Engineering Mechanics (Statics), Engineering Mathematics and Engineering Materials.

Engineering Fluid Mechanics

This subject is designed to introduce elementary fluid mechanics concepts for biomedical, civil, environmental, materials, mechanical, mechatronics and mining engineers. The topics include fluid properties, hydrostatics, manometry, Bernoulli's, mass, energy and momentum equations and their applications, dimensional analysis, fluid flow in pipes, pipe friction losses and fluid flow measurements. The lecture components will be complemented with workshops and laboratory classes. This subject intends to provide a working knowledge to solve simple fluid flow problems in the various branches of engineering. Students are assumed to have knowledge of 1st year engineering mathematics.

Machine Dynamics

Dynamics of rigid bodies and simple mechanisms in plane motion, kinematic analysis by vector and polygon methods, velocity analysis by instantaneous centres; kinetic analysis by superposition vector and force polygon methods, matrix method, method of virtual work; energy distribution method; kinematics of cam profiles; balance of rotors; introduction to CAD mechanism design; synthesis of a mechanism.

Mechanical Engineering Practice

Instruction on and use of standard machine tools (drill press, lathe, mill and hand tools) to develop a practical understanding of how mechanical systems are manufactured to drawing, evaluation of accuracy of manufacture by the trial assembly and fit of these components, demonstration of welding technologies, basic 3D modelling and associated detailed drafting, mechanical systems anatomy, production of a report and log of activity.

Engineering Analysis

Analysis for the conservation of mass, momentum and energy in engineering systems; numerical methods for the solution for a selection of problems in fluid mechanics, heat transfer, solids mechanics, bulk solids and control systems; linear algebra; eigenvalue analysis; optimisation curve fitting; roots of equation; experimentation to validate engineering analysis; ordinary differential equations; partial differential equations; use MATLAB and spreadsheets for numerical solutions of engineering problems.

Mechanical Engineering Design 1

Mechanical design process, design team working, design, material selection and analysis of fundamental machine components: power screws, clutches and brakes; spur and helical gear general forms and forces generated; shaft assemblies and their supports including shafts bearings and seals, component interfaces such as limits and fits, bolted and welded connections; keys; failure theories for static and cyclic load conditions, advanced mechanical drawing.

Thermodynamics, Experimental Methods and Analysis

This subject is designed to provide students with a range of knowledge and skills including: the understanding and use of Laws of Thermodynamics in processes and how they relate to energy use and sustainability; the understanding and use of common sensors and instrumentation equipment's; mode of operation and applications of sensors and transducers; use of advanced tools to analyse experimental and numerical data; laboratory experimental methods, data analysis and safe working practices.

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Year 3

Dynamics of Engineering Systems

Derivation of system equations for mechanical, electrical, thermo-dynamic and fluid-dynamic systems; analysis of linear, transverse and torsional vibration of mechanical systems; system classification; linearisation of system equations; linear time-invariant differential equations using transfer function representation analysis of system response in the time and frequency domain; simulation of dynamic systems.

Manufacturing Engineering Principles

This course introduces students to the basic principles of manufacturing engineering. Topics include an overall perspective on manufacturing; life-cycle and environmental factors; interactions between product design, materials and manufacturing processes; machining processes; metal cutting theory and machinability; joining and assembly processes; computers in manufacturing, NC/CIM/FMS/IMS; introduction to component handling and industrial robotics; basic metrology and geometric tolerancing; process capability and quality control; machining economics; overview of non-conventional processes and advanced manufacturing trends

Thermodynamics of Engineering Systems

Properties of pure substances; first law of thermodynamics, closed systems, control volumes; second law of thermodynamics; entropy; second law analysis of engineering systems; power and refrigeration cycles; mixtures; psychometrics and basic air conditioning.

Control of Machines and Processes

Classical control system analysis and design concepts: transient response, steady-state error analysis, frequency domain analysis, root-locus controller design methods and frequency domain controller design methods; PLC programming.

Mechanical Engineering Design 2

Review of the design process; Application of fundamental analysis to typical mechanical systems; material selection, detailed design of shafts, gears, lubrication system design, mechanical assembly detailed design, application of current design codes (e.g. for shaft design and rating helical and spur gears). Case studies. Students are required to analyze and propose solutions for a typical engineering problem. The solution would normally involve a combination of innovative thinking and the integration of design and analysis tools provided throughout but not limited to those covered in the degree program.

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Heat Transfer and Aerodynamics

One- and two-dimensional heat conduction; forced convection; heat exchangers; radiation; boundary layer flows; flow around immersed bodies; one dimensional compressible flow with and without heat transfer; normal shock waves; compressible flow in pipes.

Dynamics of Mechanisms

Lagrangian dynamics of simple rigid-body systems; inverse dynamics and forward dynamics of linkage nechanisms; balancing of mechanisms; robot dynamics including position analysis, Jacobian analysis, and dynamic analysis of serial and parallel manipulators; numerical solutions and computer simulation of multibody dynamics.

Sustainable Energy Technologies

This subject covers a number of sustainable energy technologies including the following: solar thermal systems; wind energy; hydroelectricity generation; wave power systems; biomass; photovoltaics; tidal energy; and marine current energy extraction.

Year 4

Thesis A

All students must complete a 12 credit point thesis (ENGG452) normally over a period of two. Students are expected to spend at least 336 hours on the 12 credit point thesis. The thesis is a core element of the degree in each engineering course. The knowledge and skills acquired in the design, experimentation, analysis, management and communications aspects of the course are brought together in an individual project undertaken by the student under the guidance of an academic supervisor. Individual disciplines will advise further requirements at the start of the thesis.

Managing Engineering Projects

This subject aims to provide students with the essential managerial skills and knowledge required to effectively manage engineering projects. Students will develop proficiency with the application of a range of concepts, techniques and analytical tools relating to the knowlege areas of project scope, resources, time, cost, risk and contracts management. Additionally, the subject introduces students to the ongoing challenges around the management of stakeholder expectations, various technical and social interfaces and the impact of organisational and environmental factors on successful project delivery.

Finite Element Methods in Engineering

Review of solid mechanics fundamentals and of matrix algebra; Elementary derivation of finite element methods by direct, weighted residual, and minimum total potential energy formulations; Finite element interpolation functions; natural and isoparametric coordinates; Derivation of strain-displacement relations and calculation of element stresses; Assembly and solution of system matrices; Application of constraints and local coordinate systems; Introduction to heat transfer and structural vibration problems, and finite element software in engineering applications. Some current research results will also be included in the lectures and tutorials.

Choose 2 Technical Electives

Reliability Engineering

Provides an introduction to Reliability-Availability-Maintainability (RAM) Engineering techniques applicable through the asset life cycle. Examines Requirements Analysis, Reliability Growth Modelling, Analysis of Design, Safety Assessment, Logistic Support Analysis and Sparing, Testing and Performance Evaluation, Installation Procedures and Operating Environments, Asset Management, Disposal, Asset Purchase/Replacement Policies and Decision-making. More specifically, the topics covered under this subject include terminologies for reliability engineering, failure data analysis and modelling, system reliability modelling, system maintainability & availability, design for reliability, reliability testing, reliability growth testing and reliability management.

Engineering Asset Management

This subject provides context for all of the aspects of engineering asset management. It establishes the nature of the overall activity and sets up links to the knowledge areas of strategic management, managerial finance, engineering analysis and information technology. In some ways it provides the context for engineering asset management. Further, it explores some of the basic asset management processes, particularly life-cycle and risk management. Framework, context and history of asset management, Strategic management and engineered asset management in context. Application/adaptation of basic tools; costs and benefits of lifecycle management available models and standards; Possible uses of models Business drivers; Legal requirements; Quality systems and configuration and documentation management; Interfaces with other functions (departments and organizations).

Applied Topics in Mechatronics

The intent of the subject is to bridge the gap between mechatronic engineering theory and actual industrial applications. The first part of this subject will introduce the programmable logic controller (PLC), a widely used industrial controller and Ladder Logic, the main programming language in use for PLCs. The second section will look at industrial input and output systems and the interfaces used. This will include robotic systems, motor drives, directional control valves (DCVs), vision and distance measurement. The last part will implement control systems in the PLC to perform typical manufacturing tasks.

Computational Fluid Dynamics

The subject introduces the finite difference and finite volume methods for computational fluid dynamics (CFD); explicit and implicit methods for computation; stability analyses; validation of computational results; analysis of engineering systems involving incompressible and compressible flow of fluids; and use of a commercial CFD package.

Robotics and Flexible Automation

The subject provides the knowledge and skills required to design appropriate robotic systems for flexible automation, including the modelling, analysis, design, and deployment of a robotic manipulator and its associated sensory systems. The contents will consist of: Industrial robots, as a component of automation; mathematical modelling of a robotic arm; direct and inverse kinematics model; direct and inverse dynamic model; trajectory planning; control systems for industrial robots; tactile sensors; force sensors; ultrasound sensors; computer vision; and other sensors.

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*General Education Subjects**

*Can be taken in any year of your degree

Choose 1 UAE Studies Subject

Urban Sociology

The societies and places in which we live are very complex, and the interactions of individuals, as well as social institutions, have a direct impact on the life path we take. This course provides an engaging and accessible introduction to urban sociology and the study of cities, with particular focus on the experience of the UAE and Dubai. We'll examine a number of substantive urban topics, including but not limited to the growth of cities and urban spaces in the UAE, sustainable development and practices, and the 'built' environment.

Public Health

This course will introduce Public Health as an interdisciplinary science concerned with topics central to the population of U.A.E and on a wider scale of GCC region with regard to their physical, mental, and social well- being. The course focuses on current pertinent public health problems, assessing causation and examining intervention and management strategies at personal, social, and organizational levels.

UAE and International Relations

This course offers an overview of the UAE's rapidly emerging significance and its increased roles in global networks of international relations and diplomacy. Within that overview, the course examines the internal dynamics of the UAE, in particular, the priorities that emerge from a specific workforce dependency, a construction and tourism industry that looks 'East' as much as it does 'West'. Thus the new 'Look East' policy complements the country's historical partnership with the Western states.

With the expansion of its global ties and relations, the UAE also becomes more sensitive to transnational issues, such as immigration, fluctuations in international markets or terrorism.

Society and Environment – Resources, Challenges, Futures

This subject aims to provide an understanding of relations and interactions between society and environment, including impact of societies on the Earth and its processes. Topics covered include the agricultural, industrial and urban revolutions; governance of environments; Indigenous land management; climate change; sustainability; and environmental impacts in the context of the Anthropocene.

Take 1 Arabic Language Subject or Challenge Test

Arabic Language

Language is key to everything we do. From verbal communication and the way we talk, to non-verbal communication and the emojis we use in our text messages, to the visuals we use to construct compelling visual stories, language is how we communicate. Living, studying and working the UAE, having a basic understanding of Arabic language can give you a huge competitive advantage. This introductory subject provides some of the basics of Arabic language, and you'll leave this subject able to communicate on a basic, conversational level.

Compulsory General Education Subject

Muslim Societies Across the Ages: Tradition, Secularism & Modernity

This course aims to provide students with critical thinking perspectives about the relationship between history, religion and culture, in this case, the formation of Islamic culture(s). A sociological introduction to the study of Islamic culture will introduce students to the emergence of Islam in its 7th century historical context, its relationship to the other monotheistic traditions of the region, its growth into the dominant cultural paradigm of the Near East by the 9th century, alongside its impact and contribution to key fields of medieval science and knowledge. A historical approach will help students acquire familiarity with key Islamic texts, institutions, concepts of authority, traditions of jurisprudence and spirituality, artistic expressions, as well as milestones in Islamic history. The course wraps up with a discussion of issues central to contemporary debates relating to Islamic culture, such as identity, gender, multiculturalism, pluralism, secularism and religiosity.